



## LAND SEISMIC ACQUISITION, THEORY AND TECHNIQUES COURSE OUTLINE

- ❖ **Introduction**
  - The Fundamental Seismic Principle
  - Resolution and Bandwidth
  - Energy Loss Mechanisms
- ❖ **The Energy Source**
  - Desired source qualities
  - Dynamite
    - Conventional, Poulter
    - Other surface charges
  - Vibroseis
    - Structure of a typical vibrator unit
    - Servo-valve power stage
    - Ground force signal, Correlation
  - Airgun
    - In water, On land
  - Others
    - P-Shooter, Hydra-Pulse, Vacu-Pulse
    - Betsy, Mini-Sosie, Marthor
- ❖ **The Receiver**
  - Desired receiver qualities
  - The geophone
    - Frequency, Damping, Coupling
  - The geophone string
    - Electrical advantage
    - Statistical advantage
    - Superposition advantage
    - Spatial anti-alias filter
    - Determination of coherent noise
- ❖ **CDP Method and Stacking Charts**
  - The superposition principle
  - The Multi-channel record
  - Calculation of nominal fold
  - Stacking charts
  - Bent lines
- ❖ **Analogue, Digital and Aliasing**
  - Analogue signal recording
  - Digital signal recording
  - Aliasing in time
- ❖ **Seismic Instrumentation**
  - Need for greater dynamic range
  - Basic structure of IFP instruments
  - Distributed telemetry systems
- ❖ **Delta Sigma systems**
  - Cables losses, Advantages, Disadvantages
  - Delta Sigma systems
    - Delta Sigma and noise shaping
    - 2<sup>nd</sup> order modulator
    - Delta Sigma and decimation filtering
    - Delta Sigma and 24-bit recording
    - Delta Sigma and dynamic range
  - ARAM, I/O, Sercel
  - I/O Digital sensor
  - Instrument tests and quality control
- ❖ **Spatial Sampling and Aliasing**
  - The seismic record in space
  - F-K plots and geophone intervals
  - Geophone arrays as spatial anti-alias filter
  - F-K filtering
- ❖ **Review of the Seismic Record**
  - Direct wave, refractions and other linear events
  - Reflections and multiples, velocity analysis
  - Other noise events
  - Offset considerations
- ❖ **Trapped Mode**
- ❖ **Evaluation of Noise**
  - Assorted noise
  - Ghost
  - Charge seize and depth tests
  - Random noise and determination of fold
  - Analysis of coherent noise
  - Array Theory
    - Signal to noise ratio in the wave number domain
    - Simple linear array design
    - Effective array length
    - Array response
    - Spatial convolution of linear arrays
    - Vibrator arrays
  - Estimating signal wavelengths
    - Apparent wavelength vs offset plus frequency
    - 3D Response In Line, Cross Line, Combined
  - Ghosting in the dynamite signature